Bioterrorism: the current threat

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J R Soc Med 2002;**95**:609–611

Bioterrorism is receiving ever more attention both in the popular press and in scientific publications. In the *JRSM* Beale[1] has discussed responses to the threat, particularly the requirement for a comprehensive vaccination programme; he also noted the remarkable fact that the UK's Public Health Laboratory Service is to be broken up. The South and West Region of the RSM, at its inaugural academic meeting held at Britannia Royal Naval College Dartmouth in June, addressed the subject in more general terms under the title 'Bioterrorism: the current threat'.

Overview

The opening speaker was Brigadier John Hemsley, an international authority on the military and political aspects of chemical and biological weaponry[2]. Recent scientific developments have greatly expanded the spectrum and effectiveness of both biological and chemical devices, representing a quantum leap in military potential[3]. The distinction between chemical and biological weapons has now become blurred (Figure 1). For instance, some toxins may now be synthesized in the laboratory and tailored for particular purposes[2]. Thus, both types of weapon may be conveniently grouped as CB (chemical/biological). In particular, he discussed the utility of such weapons in the hands of third-world states and terrorist organizations, where they can be a force multiplier producing a disproportionate effect by spreading panic and overwhelming the medical and logistic services. In response to the threat he suggested that the target nations, principally the western democracies, should continue the study of terrorist techniques and develop early-warning programmes. Most importantly they should formulate clear national biochemical warfare policies.

Terrorism—the new dimension

After this overview, a panel of specialists from Porton Down gave presentations on current and developing issues in their fields of research. Terrorists who formerly relied largely upon bombs and firearms are now in a position to exploit the effects of novel weapons that can be used against people, livestock, crops and water supplies. An added and almost entirely new factor is that some terrorists may seek their own death in the process—and so they are not deterred by the risk of contracting a fatal disease themselves. The threat may come from single-issue groups, religious groups or hostile states. The spectrum of attacks may extend from an individual spreading infectious agents in a crowded tube train to state-sponsored operations involving the introduction of human or livestock epidemics or crop pathogens. The last two could wreak havoc on a nation's economy. In the opinion of Major Andrew Williams, a specialist in counterinsurgency, the question of a possible bioterrorist attack was not 'if' but 'when'. He reiterated Brigadier Hemsley's view concerning the need for a clear and positive biochemical defences policy. For this to be implemented a government audit of existing capabilities will be required. Medical intelligence and surveillance must be accorded very high priority. The acquisition by non-government organizations of CB war mechanisms would be monitored and controlled. In the case of a chemical incident the fire, police and ambulance services will be immediately concerned. In a biological incident the medical and public health services would be the first to be involved. Military support must be integrated with the civilian services and should include detection machinery and vaccination stocks. Integration of all the necessary disciplines should be preplanned and routinely practised before emergencies occur.

Developing a defence strategy

In formulating a biochemical defence policy, hazard assessment is an essential factor. Thus the utility and advantages and disadvantages of CB weapons require careful consideration. In general war, the use of CB weapons would do little harm to the infrastructure of territory to be occupied—an advantage for the user. The fact that they may incapacitate rather than kill outright is an important consideration. This is because they could overwhelm the medical and casualty services, whereas the dead have no need of either. However, at present, weaponization and dispersion of CB weapons present difficulties. Accurate targeting is seldom possible and collateral effects may occur in the attacker's own troops; moreover, retribution in kind might also follow. In CB attacks on civilian populations the

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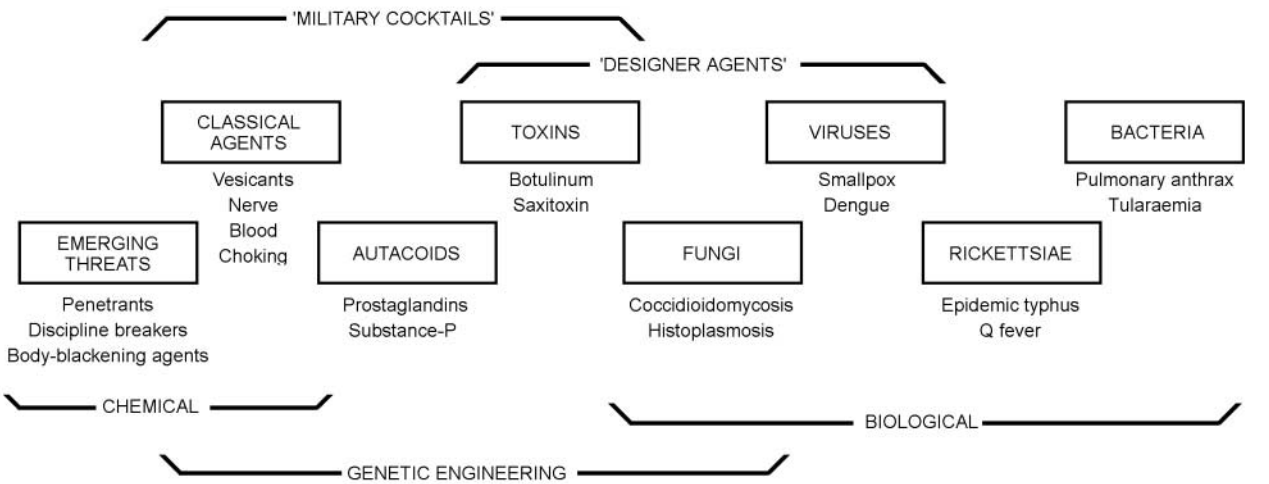

Figure 1 **The chemical and biological spectrum** (from Ref. 2)

fear factor works to the advantage of the terrorist. The use of anthrax letters illustrates this point; additionally this method allows for a delayed onset of infection, enabling the perpetrators to move away and attack elsewhere. CB agents may be used as weapons of mass destruction by spreading epidemics among human or animal populations or commercial crops while avoiding collateral damage to the infrastructure. It is not generally recognized that, although many CB agents are easy and cheap to produce, effective detection and countermeasures are as yet inadequate to meet a large-scale challenge. Little progress has been made on antivirals and vaccine research, and development requires further input[1]. The threat of a smallpox attack by terrorists is of particular concern.

Understanding aerobiology

The delivery and dissemination of micro-organisms depends on numerous factors and here aerobiology research is of prime importance. Aerobiology is the relation between the atmosphere and living entities (i.e. micro-organisms) and the spread of an organism depends on its ability to survive in the atmosphere. In ancient warfare, plague was disseminated by use of catapults to hurl infected corpses into the enemy fortress. Nowadays, knapsack sprayers or crop-spraying light aircraft might be used to disseminate CB agents. Larger aircraft could also be used for wider distribution but here the survival of micro-organisms would probably be reduced and detection made easier. Guided weapons, artillery shells or aerial bombs might be used to target a specific area but this method might make agents more labile. Examples of disease that could be disseminated by air are anthrax, tularaemia and brucellosis. Dissemination is affected by wind, sun, humidity and night/day discharge.

Box 1 **Typology of potential biological warfare disease** (from Ref. 2)

Bacterial	Fungal
Anthrax	Coccidioidomycosis
Brucellosis	Histoplasmosis
Cholera	Nocardiosis
Melioidosis	
Plague (pneumonic)	Viral
Plague (bubonic)	Influenza
Tularaemia	Ebola fever
Typhoid fever	Marburg fever
	Lassa fever
Rickettsial	Smallpox
Q-fever	Venezuelan equine encephalitis
Rocky Mountain spotted fever	Various potential arboviruses
Epidemic typhus	
Chlamydial	
Psittacosis	

Experimental discharges of benign microorganisms were conducted some years ago. When the test substance was dropped from the rear of an underground train, extensive dissemination was demonstrated. The push–pull of air in the tube stations, poor light and humidity proved favourable factors for distribution and survival of the culture. At Lyme Bay in the UK, organisms were released from ships at right angles to the prevailing wind. In the Sverdlovsk incident 1 g of agent followed the prevailing wind and killed sheep at 50 km. Experiments in the USA showed that the agents of tularaemia and Q-fever, discharged downwind, could effectively spread clinical disease to animals.

Table 1 **Some biological warfare toxins** (from Ref. 2)

Toxin	*Produced by*	*Symptoms*	*Effect*
Staphylococcal enterotoxin	Bacteria	Headache, nausea and vomiting, diarrhoea (severe prostation)	Incapacitating for 6–48 h
Botulinum toxin	Bacteria	General weakness, double vision, dizziness, weakness of muscles	80% lethal without medical care (if ingested), 25% lethal with good medical care
Trichothecene mycotoxin (yellow rain)	Fusaria species of fungi	Nausea, vomiting, blood-filled blisters on skin, internal bleeding	Lethal in 5% of cases; an incapacitating agent
Cobra neurotoxin	Cobra snake	Numbness, tiredness, clouding of consciousness, dimming of vision, weakness of muscles, paralysis of breathing	Usually lethal
Palytoxin	Marine corals	Cardiac arrest due to constriction of blood supply	Lethal. Fast-acting when absorbed into skin cut
Ricin	Castor oil plant and seeds	Abdominal pain, fever, burning in the throat, muscle weakness, convulsions, collapse	Lethal with high doses
Tetrodotoxin	Puffer fish	Muscle weakness, collapse	Lethal

Further education of the healthcare professions

Members of the medical and allied professions will probably be aware of the names and characteristics of many of the microorganisms and toxins in the terrorists' CB armoury. However, few in the developed world are likely to have much experience of dealing with the sort of epidemic or acute local outbreak that might follow an attack by terrorists armed with CB weapons. Examples of these are shown in Box 1 and Table 1. When an attack does occur it is likely to be without warning, and early diagnosis, treatment and widespread prophylaxis will be vital. This will not be easy and some delay in accurate diagnosis will be inevitable. Many casualties may occur before effective remedies can be applied. In the case of anthrax, with its incubation period of 1–56 days, mass panic could occur in a target population. Many 'designer' organisms and toxins are being researched and could soon be coming off the production line.

Conclusion

It must be assumed that CB weapons are being further developed and refined and will at some stage—perhaps soon—be used against military targets and civilians in the west. To those of us whose calling is the prevention and alleviation of disease and suffering, they are particularly abhorrent. However, CB weapons are here to stay. In selecting this distasteful but very relevant subject for its inaugural academic meeting, the RSM South and West Region has illuminated an area which will now demand the increasing and close attention of the medical and related professions.

Note Speakers at the meeting were: Brigadier J Hemsley (Setting the Scene); Major Andrew Williams (The Current Threat and Measures for Response); Mr Stephen Eley (Hazard Assessment—Biological Weapons); Dr Michael Green (Aerobiology of Microorganisms); and Dr Tim Brooks (Diseases, Individual Susceptibility, Response and Prophylaxis).

REFERENCES

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3 Hemsley J. The influence of technology on Soviet doctrine. In: Hemsley J, ed. *The Lost Empire—Perceptions of Soviet Policy Shifts in the 1990s*. London: Brassey, 1991:172